Figure 1. Treatment delivery scenarios investigated along with the dose distribution in the axial plane. a) noncoplanar static beams b)DWA treatment using a template-based trajectory c) $_{CDR}$VMAT denotes a coplanar arc solution with MLC filed shape modulation, but constant gantry speed and constant dose rate.

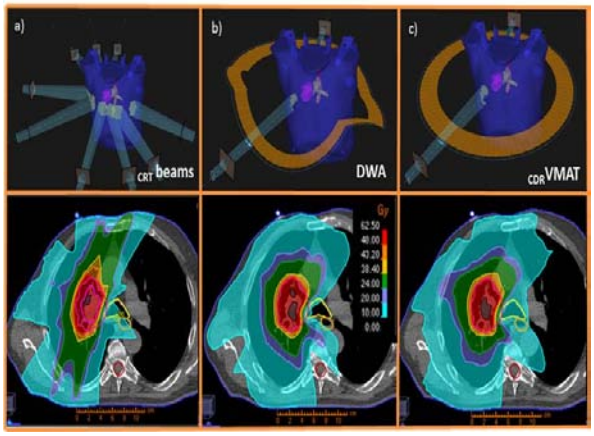

Table 2: Summary of the results of the target volume dose distribution and delivery parameters for all investigated scenarios. The data is presented as average values, standard deviations and p-test value

		CRT/IMRT	DWA	CDR VMAT
Prostate n=3	Coverage PTV $D_{95\%}$	0.99 ± 0.01	0.98 ±0.03 (p=0.95)	0.98 ± 0.03 (p=0.90)
	Low dose spillage	3.99 ± 0.21	3.81 ± 0.22 (p=0.66)	4.08 ± 0.58 (p=0.49)
	MU	531 ± 45	495 ± 2.31 (p=0.24)	463 ± 54 (p=0.36)
	Actual time	5.55 ± 0.45	1.59 ± 0.01(p<0.01)	1.23 ±0.11 (p<0.01)
Oligo-metastatic cases n=15	Coverage PTV $D_{95\%}$	0.96 ± 0.1	0.98 ± 0.05 (p=0.27)	0.97 ± 0.07 (p=0.35)
	Low dose spillage	5.98 ± 2.33	4.87 ± 1.23 (p<0.01)	5.03 ± 1.03 (p=0.25)
	MU	975 ± 211	1370 ± 346 (p<0.01)	1320 ± 309 (p=0.29)
	Actual time	5.47 ± 1.04	3.44 ± 0.88 (p<0.01)	3.46 ±0.88 (p=0.94)
Centrally-located NSCLC n=9	Coverage PTV $D_{95\%}$	0.84 ± 0.20	0.91 ± 0.06 (p=0.21)	0.90 ± 0.09 (p=0.26)
	Low dose spillage	5.39 ± 1.24	4.43 ± 1.06 (p<0.01)	4.58 ± 1.02 (p=0.11)
	MU	1885 ± 477	3349± 896 (p<0.01)	3238 ± 809 (p=0.29)
	Actual time	7.08 ± 1.09	8.45 ± 2.32 (p=0.18)	8.59 ± 2.29 (p=0.90)
LAPC n=10	Coverage PTV $D_{95\%}$	0.71 ± 0.23	0.76 ± 0.13 (p=0.59)	0.76 ± 0.15 (p=0.94)
	Coverage GTV $D_{95\%}$	0.81 ± 0.17	0.85 ± 0.15 (p=0.53)	0.86 ± 0.18 (p=0.10)
	Low dose spillage	3.70 ± 0.28	3.25 ± 0.22 (p<0.01)	3.34 ± 0.22 (p=0.90)
	MU	1091 ± 100	644 ± 65 (p<0.01)	704 ± 87 (p=0.10)
	Actual time	6.83 ± 0.41	2.42 ± 0.01 (p<0.01)	2.51 ± 0.28 (p=0.63)

Conclusion: DWA combines direct machine parameter optimization with noncoplanar geometry, allowing additional flexibility in dose delivery, while preserving dosimetrically robust delivery.

Proffered Papers: RTT 5: Optimizing treatment planning and delivery in the pelvic region

OC-0467

Can a VMAT radiotherapy planning solution match brachytherapy in cervical cancers?

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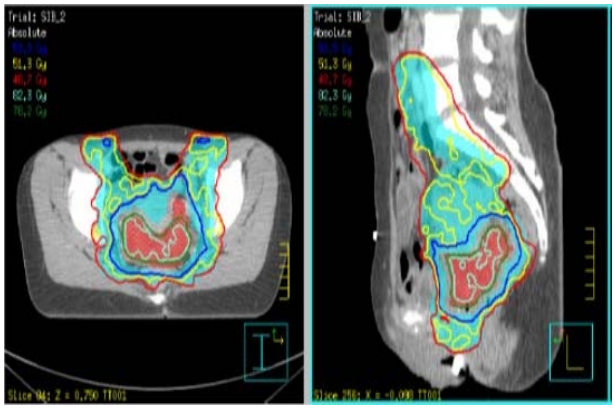
Purpose or Objective: Radiotherapy treatment for cervical cancers typically involves external beam irradiation to the whole pelvis followed by an intra-uterine brachytherapy boost to the primary tumour site. The purpose of the current study was 1) to assess dose reduction to OARs using a VMAT treatment technique compared to a conformal four field brick and 2) whether VMAT using sequential or simultaneous integrated boost can provide coverage to the tumour and OARs similar to brachytherapy.

Material and Methods: Ten patients previously treated for cervical cancer were identified (age range 30-78 years). Four plans were retrospectively produced for each patient (3D conformal four field brick, VMAT to the whole pelvis, VMAT boost, SIB) providing a phase one dose of 50.4Gy over 28 fractions. The sequential boost dose varied between patients from 16.5Gy-27.5Gy over 3-5 fractions. An averaged boost dose of 31Gy over 32 fractions, corrected using biological equivalent dose calculations was used for all SIB plans. All data was corrected to EQD2.

Figure1: Typical dose distribution for a VMAT with SIB plan.



Results: Results demonstrated significantly improved dose homogeneity between the VMAT and four field phase one techniques ($p<0.01$) but failed to find significant dose reductions to the bladder and rectum. Dose to the bowel was reduced at all dose points ($p<0.01$). Comparing the VMAT and brachytherapy boost, significantly increased doses to OARs were identified in the VMAT boost (bladder $p<0.05$; rectum $p<0.01$; bowel $p<0.01$). Dose homogeneity was decreased using an SIB compared to sequential but OAR doses were also decreased ($p<0.05$).

Table 1: Mean and standard deviation of OAR data contained within the SIB and VMAT phase one plus either boost or brachytherapy plan combinations.

		Bladder		Rectum		Bowel	
Plan	Data-Point	Mean/Gy	S.D./Gy	Mean/Gy	S.D./Gy	Mean/Gy	S.D./Gy
VMAT + VMAT boost	D_{2cc}	81.03	10.16	80.14	9.55	84.46	9.11
	D_{10cc}	70.87	11.94	69.92	16.31	74.03	11.42
	D_{50cc}	54.40	17.18	54.79	16.28	59.01	11.48
	D_{100cc}	55.38	9.03	58.25	10.30	54.00	6.96
VMAT + Brachytherapy	D_{2cc}	79.79	7.88	67.03	4.99	70.29	7.07
	D_{10cc}	67.18	5.74	57.45	7.73	62.80	4.05
	D_{50cc}	45.14	18.50	37.30	20.31	55.23	2.57
	D_{100cc}	32.32	21.69	36.09	23.80	51.80	2.47
SIB	D_{2cc}	68.86	9.73	72.34	12.06	69.66	13.24
	D_{10cc}	55.12	9.54	55.98	15.28	57.31	12.94
	D_{50cc}	43.84	8.17	45.82	4.38	49.99	3.11
	D_{100cc}	42.55	6.08	45.17	3.28	48.48	0.89

Conclusion: When treating cervical cancer, VMAT allowed significant improvement in dose homogeneity with overall reductions in doses to OARs. When comparing the feasibility of SIB or sequential EBRT boost instead of brachytherapy the SIB plan produced a better solution with respect to OAR doses. Whilst cervical surface doses with SIB to the high-risk CTV will not match brachytherapy a SIB may offer an alternative option for those patients who refuse/cannot access brachytherapy.

OC-0468

Validation of Mask Based Registration in CBCT pretreatment imaging of locally advanced cervix ca

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